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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/519,355	12/19/2005	Gerard Hillion	PET-2170	2996
23599 7590 12/12/2008 MILLEN, WHITE, ZELANO & BRANIGAN, P.C. 2200 CLARENDON BLVD. SUITE 1400 ARLINGTON, VA 22201				
EXAMINER				
BULLOCK, IN SUK C				
ART UNIT		PAPER NUMBER		
1797				
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12/12/2008		PAPER		

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/519,355

Applicant(s)

HILLION ET AL.

Examiner

In Suk Bullock

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 September 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 and 23-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-21 and 23-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/S5108)
Paper No(s)/Mail Date 12/28/04.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____.
- 5) ☐ Notice of Informal Patent Application.
- 6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

In response to the amendment filed, objection to claim 7 and rejection of claims 12 and 13 under 35 USC 112, 2nd are hereby withdrawn.

Cancellation of claim 22 and addition of claims 24 and 25 are acknowledged.
Thus, claims 1-21 and 23-24 are pending in this application.

The following is a new ground of rejections.

Claim Objections

Claim 3 is objected to because of the following informalities: "acarboxylate" should be corrected to "a carboxylate".

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-9, 12, 24, and 25 are rejected under 35 U.S.C. 102(b) as being anticipated by US Patent 3,917,737 to Yoo (hereinafter "Yoo").

Yoo discloses a process for hydrogenation of a diolefin compound having from 2 to about 30 carbon atoms (col. 8, lines 47-68) using a catalyst comprising (a) a metal selected from iron, cobalt, nickel and mixtures thereof, (b) an organometallic reducing

agent, and (c) a ligand (col. 1, lines 24-48). The transition metal is selected from halides and acetylacetonates (col. 3, lines 22-23), the organometallic reducing agent is at least one metal selected from Group IA (i.e., lithium, sodium) and IIIA (i.e., aluminum) (col. 3, lines 28-32), and the ligand may be hydrocarbon-substituted organophosphines or hydrocarbon-substituted electron donor ligands of Group VA (col. 4, lines 12-48). Yoo further discloses that the catalyst may be in a liquid solvent phase and exemplary suitable solvents include aromatic and aliphatic hydrocarbons (col. 7, lines 38-51).

The diolefin compound having 2 to 30 carbon atoms disclosed by Yoo includes the claimed 1,3-butadiene. Although Yoo does not explicitly disclose that 1,3-butadiene is converted to cis-2-butene, the process of Yoo would have inherently produced such claimed product since the feed and the catalyst are the same as that which are claimed.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 10, 11, and 17-23 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 3,917,737 to Yoo (hereinafter "Yoo").

Yoo discloses a hydrogenation of a diolefin compound having from 2 to about 30 carbon atoms (col. 8, lines 47-68) using a catalyst comprising (a) a metal selected from iron, cobalt, nickel and mixtures thereof, (b) an organometallic reducing agent, and (c) a ligand (col. 1, lines 24-48). The transition metal is selected from halides and acetylacetonates (col. 3, lines 22-23), the organometallic reducing agent is at least one metal selected from Group IA (i.e., lithium, sodium) and IIIA (i.e., aluminum) (col. 3, lines 28-32), and the ligand may be hydrocarbon-substituted organophosphines or hydrocarbon-substituted electron donor ligands of Group VA (col. 4, lines 12-48). Yoo further discloses that the catalyst may be in a liquid solvent phase and exemplary suitable solvents include aromatic and aliphatic hydrocarbons (col. 7, lines 38-51). Additionally, Yoo discloses the amounts of the reducing agent per mole of iron, cobalt or

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nickel is about 5 to 30 (col. 1, lines 49-54) and the molar ratio of ligand to iron, cobalt or nickel is often about 0.5 to 15:1 (col. 2, lines 31-33).

Yoo fails to disclose the claimed minor proportion of the transition metal (claim 10) and that the principal metal is iron and the additional metal is selected from Co, Ni, Cu, Rh, Pd, Mn, Mo, W, and V (claim 11).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Yoo by selecting any combination of the three metals disclosed, Fe, Co, and Ni including the claimed combination with an expectation of achieving relatively equivalent results.

With regard to claimed process for producing 1-butene from a rich C₄ cut (claim 23), Yoo discloses hydrogenation of a feed from a petroleum refining industry (col. 8, lines 47-59). It is known to those skilled in the art that a C₄ cut may be obtained from petroleum refining and that the feed would contain some level of 1,3-butadiene. Because the process of Yoo encompasses the claimed process, it would have been expected that the process of Yoo would have resulted in a feed containing a reduced level of 1,3-butadiene including the claimed level of less than 10 ppm by weight.

Claims 13-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over US Patent 3,917,737 to Yoo (hereinafter "Yoo") in view of US Patent 6,040,263 to Musmann et al. (hereinafter "Yoo").

Yoo fails to disclose using an ionic liquid as a solvent.

Mussmann disclose hydrogenation of diolefins (i.e., 1,3-butadiene to butene) using a catalyst comprising transition metal complex with ligands (col. 3, lines 5-36 and col. 4, lines 4-17). Mussmann further discloses using non-aqueous, ionic solvent to at least partially dissolve the catalyst (col. 1, line 51 to col. 2, line 67). Mus

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have modified the process of Yoo by utilizing the non-aqueous, ionic solvent as disclosed by Mussmann because Mussmann has discloses that the reaction products can be advantageously separated by simple settling out of the polar catalytic phase containing the molten salt and the major portion of the catalyst and recycling the polar phase containing at least a portion of the catalyst (col. 4, lines 35-41). The combination of Yoo and Mussmann is deemed proper since both are directed to the same dehydrogenation process employing the same transition metal salt and ligand.

Response to Arguments

Applicants' arguments filed 9/26/2008 have been fully considered but they are not persuasive.

With regard to the unexpected results shown in Table 4 on page15 of the specification, this is not persuasive because the comparison is not with the applied art to Yoo and Mussmann combined.

It appears that Applicants are arguing that the catalyst of Yoo is a heterogeneous catalyst and, therefore, cannot be a liquid catalyst as claimed by Applicants. The

argument is not persuasive because a heterogeneous catalyst can be a liquid or a solid catalyst. If the liquid catalyst is immiscible with a feed then it is a heterogeneous catalyst. However, in the case of Yoo, the reference clearly discloses that the catalyst can be in the liquid form (see col. 7, lines 38-40).

Applicants argue that Yoo does not suggest "the conversion of 1,3-butadiene into cis-2-butene, much less with the unexpectedly high selectivities achieved by Applicant's invention." This argument is not persuasive because Yoo's teaching of diolefins of from 2 to about 30 carbon atoms encompasses the claimed 1,3-butadiene. Additionally, since the catalyst of Yoo is similar to the claimed catalyst, it would have been expected that the process of Yoo would inherently have yielded similarly claimed results, i.e., high selectivity to cis-2-butene product.

Applicants argue that Mussmann does not disclose or suggest "that the resultant catalyst can be used to convert 1,3-butadiene to predominantly cis-2-butene much less with over 98% selectivity." This argument is not persuasive because Mussmann was relied upon for the teaching of ionic liquid solvent. Moreover, it should be noted that an obviousness rejection was based upon a combination of references, i.e., Yoo and Mussmann. In any event, it is noted that Mussmann does in fact explicitly disclose hydrogenating conjugated dienes such as 1,3-butadiene to butene (col. 4, lines 6-15) which encompasses the claimed conversion to cis-2-butene. It is expected that the combination of Yoo and Mussmann would have resulted in the claimed conversion of 1,3-butadiene to predominantly cis-2-butene as claimed.

In view of the above, the arguments are not found to be persuasive.

Conclusion

Applicants' amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to In Suk Bullock whose telephone number is 571-272-5954. The examiner can normally be reached on Monday - Friday 6:00-2:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Glenn Caldarola can be reached on 571-272-1444. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/In Suk Bullock/
Examiner, Art Unit 1797